

Evaluation of Bacteriological Quality of Some Selected Table Water

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Abstract: Twenty six (26) brands of table water samples were purchased. These were analyzed for their microbial quality using standard microbiological techniques. The microbial count of the samples ranged from 10-65 cfu/100mL and 20-90 cfu/100mL for total and faecal coliforms respectively. Bacteria isolates include *Escherichia coli*, *Citrobacter* sp., *Klebsiella* sp., *Bacillus* sp., *Staphylococcus aureus*, *Streptococcus* sp. and *Pseudomonas* sp. with percentage of occurrence 71%, 14%, 27%, 14%, 43%, 57% and 48% respectively. Susceptibility of the bacterial isolates to commercial antibiotics examined showed that *E. coli*, *Klebsiella* and *Streptococcus* sp. were susceptible to gentamycin by 55.26%, while *Klebsiella* and *Streptococcus* were susceptible to perfloxacin by 24.3%. *Pseudomonas* sp., *Bacillus* sp., *Staphylococcus aureus* and *Streptococcus* sp., were resistant to ampiclox. *Streptococcus* sp., *Bacillus* sp. and *Staphylococcus aureus* were resistant to erythromycin by 55.26%. All the bacterial isolates are enteric in nature except *Staphylococcus* sp. and *Bacillus* sp. The organisms may probably be pathogenic. Result obtained indicates that none of the water samples conform to the drinking water quality standard. It can be deduced that the water samples is not completely safe for human consumption.

Key words: Antibiotics, Coliforms, Table water, Antimicrobial, Susceptibility.

Introduction

The usual sources of drinking water are the streams, rivers, well and boreholes which are mostly untreated and associated with various health risks (Okonko *et al.*, 2008). In developing countries like Nigeria, the populace relies on the table water produced by different industries as the sole source of drinking water. There is no evidence that this table water is free of microbial contamination. Water is essential, but when polluted it may become undesirable substance dangerous to human health (Victoria *et al.*, 2008). Many infectious diseases are transmitted by water through the fecal-oral route. Portable water is the water that is free from disease producing microorganisms and chemical substances that are dangerous to health (Alabaster *et al.*, 1999). The ingestion of contaminated drinking water can lead to variety of diseases including diarrhoea, leptospirosis, cholera, typhoid fever. Statistical report indicates 80% rate of death from water borne diseases between 2002 and 2006, and water illness resulting to more than 40,000 outbreaks. The increase in outbreak of water borne diseases and illnesses suggest the need of analyzing the bacteriological quality of table water for protection of public health (Gilliland *et al.*, 2011). This study aimed at investigating the bacteriological qualities of some bottle water for consumption and to examine the susceptibility of the bacterial isolates to standard antibiotics.

Materials and methods

Collection of samples

Twenty-six table water samples were selected from different producers in selected state of Nigeria. The state include: Niger, Kwara, Ibadan, Lagos, Kaduna, and Zaria. The table water samples were labeled with their corresponding company name, registration no, expiry date, manufacturers name, location and batch number.

Bacteriological analysis

Enumeration of total heterotrophic bacteria

The membrane filtration method was used. Millipore membrane filter was sterilized with the use of hot air oven for 2hrs at 150°C. Sterile millipore filter of 0.45 µm size which contain 100 filters in it pack was used under vacuum. Sterile forceps was used to pick the millipore filter, and placed at the base of the membrane filter. Measuring cylinder was used to measure 100mL of table water sample and poured into the assembled funnel. Sterile forcep was use to carefully remove the millipore filter disk after disassembling the funnel and place on solidified general purpose medium. These were incubated at 37°C for 24hrs - 48hrs after which distinct colony was recorded.

Enumeration of total coliform

Sterile 0.45 µm millipore filter was used under vacuum. Sterile forceps was used to pick the millipore filter, and placed at the base of the membrane filter. Measuring cylinder was used to measure 100mL of table water sample and poured into the assembled funnel. Sterile forcep was use to carefully remove the millipore filter disk after disassembling the funnel and place on the different solidified MaConkey agar

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medium. These were incubated at 37°C for 24hrs - 48hrs after which distinct colony was recorded.

Enumeration of fecal and coliform count

Sterile 0.45 µm millipore filter was used under vacuum. Sterile forceps was used to pick the millipore filter, and placed at the base of the membrane filter. Measuring

cylinder was used to measure 100mL of table water sample and poured into the assembled funnel. Sterile forcep was use to carefully remove the millipore filter disk after disassembling the funnel and place on the different solidified Eosin methyl blue (EMB) agar medium. These were incubated at 45°C for 24hrs - 48hrs after which distinct colony was recorded.

Table 1: Properties of the table water samples

	Sample Name	Location	Expiry date	Manufacture data	Batch No
1	Votic	Surulere	14/08/14	14/08/13	F1
2	Swan	Ikorodu	26/04/14	26/04/13	0005270
3	Golden Age	Madara	09/2/2014	10/2/13	B165
4	Morgy	Asa –dam	22/10/14	25/10/13	BN109
5	Visleri		26/04/14	26/04/13	VL227
6	Mujit	Asa- dam	3/11/14	3/11/13	1311
7	Seap	Olorunsogo	28/07/14	30/07/13	206
8	Heritage	New-yidi	10/11/14	11/11/13	19
9	Mirth	Agege	11/12/14	12/12/13	004
10	Sabo	Sharia court	09/20/14	10/10/13	1256N
11	Spring	Ikorodu	08/10/14	08/10/13	2
12	Aqua	Harmony estate	10/11/14	10/11/13	Q1
13	Maizube	Kampala	25/04/14	20/12/13	9972
14	Mowa		19/11/14	31/6/13	A1
15	Dato	Olorunsogo	27/07/14	27/07/13	B3
16	Nestle	Ilupeju	24/04/14	3/12/13	3114
17	Dje	Obaro crescent	22/09/14	30/10/13	3
18	Safina	Eyenkori	30/11/14	30/10/13	9
19	Diamond	Tayese estate	18/07/14	18/07/13	3787
20	Hydro	Igbesa R.d	23/08/14	23/08/13	EW34NU
21	3dees		10/11/14	10/11/13	385
22	Zainox	Olotu street	09/12/14	09/12/13	12
23	Pals	Ring Road	15/5/14	15/5/13	0023
24	Spring	Ikurodu	08/10/14	08/10/13	2
25	Eva	IDDO	09/11/14	09/11/13	4
26	Bg	Garden	21/14/	21/14	9

Results**Table 2: Bacteriological characteristics of the table water studied in cfu/100mL**

Samples	Total heterotrophic count (37°C)	Total coliform count (37°C)	Fecal coliform count (45°C)
Votic	2	10	1
Swan	10	2	0
Golden age	0	4	1
Morgy	4	3	1
Visleri	4	3	2
Mujit	0	1	1
Seap	15	5	4
Heritage	9	18	14
Mirth	2	4	0
Sabo	10	2	0
Spring	2	0	0
Aqua	0	8	0
Maizube	2	65	20
Amin	1	10	0
Mowa	1	1	0
Nestel	10	35	10
Dje	1	8	4
Safina	0	20	8
Diamond	1	10	0
Hydro	5	3	1

Table 3: Percentage occurrence of the isolated microorganisms**Table 4: Occurrence of bacteria isolated in water obtained from sample**

Samples	<i>Streptococcus</i>	<i>Bacillus</i>	<i>E. coli</i>	<i>Klebsiella</i>	<i>Staphylococcus</i>	<i>Citrobacter</i>	<i>Pseudomonas</i>
Pals	-	-	+	-	-	-	-
Diamond	-	-	-	-	-	-	+
Zanox	-	-	-	-	+	-	-

S/n	Isolates	Number of Occurrence	% of Occurrence
1	<i>Streptococcus</i>	4	57%
2	<i>Bacillus</i>	1	14%
3	<i>E. coli</i>	5	71%
4	<i>Klebsiella</i>	2	29%
5	<i>Staphylococcus</i>	3	43%
6	<i>Citrobacter</i>	1	14%
7	<i>Pseudomonas</i>	3	43%

3dees	+	-	-	-	-	-	-
Mirth	+	-	-	-	-	-	-
Hydro	-	-	-	-	-	-	+
Golden age	-	-	-	-	-	+	-
Safine	-	-	-	+	-	-	-

Mazuibe	-	-	+	-	-	-	-
Dje	-	+	-	-	+	-	-
Morgy	+	-	-	-	-	-	-
Heritage	-	-	+	-	-	-	-
Nestle	+	-	-	-	-	-	-
Seap	-	-	-	-	-	-	+
Mowa	-	-	-	-	+	-	-
Spring	-	-	+	-	-	-	-
Sabo best	-	-	+	-	-	-	-
Swan	-	-	-	+	-	-	-

Keys: - = Absent, + = Present

Table 5: Antibacterial susceptibility to standard drug

Gram-negative bacteria	Antibiotics	Zone of inhibition	Susceptibility
<i>E. coli</i>	S-Streptomycin	No Inhibition	Resistance
	GN- Gentamycin	30mm	Susceptible
	AU- Augmentin	No Inhibition	Resistance
	SP- Sparfloxacin	24mm	Susceptible
	OFX-Tarivid	22mm	Susceptible
<i>Streptococcus</i> sp	GN- Gentamycin	25mm	Susceptible
	PEF- Pefloxacin	24mm	Susceptible
	E-Erythromycin	No Inhibition	Resistance
	SXT- Septrin	No Inhibition	Resistance
	APX-Ampliclox	20mm	Susceptible
<i>Klebsiella</i> sp	PEF-Pefloxacin	30mm	Susceptible
	SXY- Septrin	13mm	Susceptible
	CN- Gentamycine	26mm	Susceptible
	AU- Augmentin	26mm	Susceptible
	OFX-Trivid	14mm	Susceptible
<i>Pseudomonas aeruginosa</i>	AM-Amoxacillin	17mm	Susceptible
	SXT-Septrin	No Inhibition	Resistance
	CPX-Ciprofloxacin	No Inhibition	Resistance
	CH-Chloramphenicol	No Inhibition	Resistance
	PEF-Pefloxacin	No Inhibition	Resistance
<i>Bacillus</i>	E- Erythromycin	No Inhibition	Resistance
	GN-Gentamycine	No Inhibition	Resistance
	APX-Amplicox	No Inhibition	Resistance
<i>Staphylococcus</i>	CN-Gentamycin	No Inhibition	Resistance
	APX-Ampiclox	No Inhibition	Resistance
	E-Erythromycin	No Inhibition	Resistance
	PEF-Pefloxacin	No Inhibition	Resistance

Discussion

The result obtained indicated the presence of bacteria in the bottle water samples examined. The occurrence of bacterial isolates in table samples showed that *E. coli* occurred in high percentage while *Klebsiella* sp., *Streptococcus* sp., and *Staphylococcus* sp. and *Bacillus* sp. were present in decreasing order. According to world health organization standard (2006), which state that for every water sample to be portable, fecal coliform per 100mL should be zero and total coliform per 100mL should be ten. (WHO, 2006). The presence of significant members of any coliform in portable water indicates either deficiencies in treatment of the water or inadequate protection of the

source of untreated water (Borchardt and Walton, 1971). It has also been detected in drinking water and evidence of such contamination has been noted. The presence of this pathogenic and indicator organisms in these water samples render them unfit for human consumption. Water should meet different quality, specification depending on the particular uses. Thus, table and domestic water should be harmless for the health of man and should have proper bacteriological qualities. In summary some sold table water is highly contaminated. This is due to the indiscriminate disposal of their fecal waste, production process or packing of water which need to be screened before produced for consumption. The presence of *E. coli*, *Streptococcus*

sp., *Klebsiella* sp., *Bacillus* sp. and other enteric organism should be called for serious concern.

Conclusion

It was discovered from this study that 14 out of the table water sold for consumption meet the WHO standard and 12 table water did not. Those 12 table water that did not meet the WHO standard could constitute a serious threat to the public health. Therefore, effort should be made toward proper sanitation and regular monitoring of table water sold for consumption in order to minimize public health hazard and rate of death by water borne diseases.

Recommendation

Result of the microbial load obtained in the table water indicates that there is risk in the usage of the table water. It can be deduced that all the water samples were not conform to the drinking water quality standard. Fecal coliform per 100mL should be zero while the total coliform per 100ml should not exceed ten. Due to the tremendous usage of table water for drinking purposes around the world, it is imperative that table water producers ensure the conformity to the standard, as this will reduce health associated risk of the consumers.

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